SHORT COMMUNICATION

Iodine Nutrition in Upper Socioeconomic School Children of Delhi

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Received: September 5, 2008; Initial review: November 4, 2008; Accepted: February 2, 2009.

We assessed the iodine nutrition of upper socioeconomic strata school children from Delhi to identify its association with goiter, thyroid autoimmunity or thyroid function. After informed consent of parents, all assenting students (n=997) from one randomly selected section of each class from five private schools representing all the zones of Delhi) were evaluated for goiter, urinary iodine excretion, thyroid function and antibody status. Median urinary iodine was 35.28µg/dL. Goiter was present in 123 (12.3%) and positive anti-TPO antibodies in 17 (2.6%). Increased urinary iodine was associated with thyroid dysfunction, though not with goiter.

Key words: *Goiter, Iodine nutrition, India, Thyroid function, Urinary iodine excretion.*

Published online: 2009. April 10. ***PII : S097475590800546-2***

Following the implementation of National Iodine Deficiency Disorders Control Programme (NIDDCP) based on Universal Salt Iodization (USI), there are reports of normalization of iodine nutrition as reflected by urinary iodine excretion (UIE) from the country(1,2). Our objective was to assess iodine nutrition in upper socioeconomic status (USES) school children as quantified by median UIE. We also correlated the iodine nutrition status with goiter, thyroid autoimmunity and thyroid functional status.

METHODS

This cross sectional study, conducted in Delhi and the National Capital Region was approved by the ethics committee of the Institute of Nuclear Medicine and Allied Sciences, Delhi. Data were collected from five private schools with consent from the school authorities, parents/ guardians and a verbal assent from the children. In each school, all students from one randomly selected section of each class (I-XII) were included. Clinical examination, including assessment of goiter, was done by two experienced endocrinologists and graded as per the WHO(3).

Each subject provided 5 mL blood (serum stored at –20ºC) and random spot urine (stored in plastic screw capped containers at 4ºC) for analysis. Serum was analyzed for FT_3 and FT_4 by radioimmunoassay (Immunotech, Beckman Coulter), TSH by immunoradiometric assay (Immunotech, Beckman Coulter) and anti-TPO (anti-thyroid peroxidase) antibodies by electrochemiluminescence assay (Cobas – Roche Elecys 1010 analyser). Urine was analyzed for iodine content by the wet ashing method using perchloric acid vanadate system as described previously(4,5).

Statistical analysis: Analysis was done using STATA 9.0. Data are presented as mean ± S.D or median

(range) as appropriate. Continuous variables are compared between groups by independent Student's *t* test/Wilcoxon rank sum test. Pearson's /Spearman's rank correlation was used to assess strength of relationship between UIE and FT_3, FT_4 and TSH, respectively. *P* value <0.05 was considered statistically significant.

RESULTS

A total of 997 students (aged 5-18 years) were approached. Of these, 789 assented for blood sampling. Anti-TPO antibodies could be analyzed in 651 due to lack of sufficient sample in others. ***Table* I** provides clinical and biochemical characteristics of study population.

Among the 123 subjects with goiter, anti-TPO Abs were tested in 85 and found positive in 10 (11.76%). The median UIE of TPO Ab negative subjects was higher than that in TPO Ab positive children (***Table* II**). Mild iodine deficiency was found in 2 subjects (0.19%). UIE showed positive correlation with TSH ($r = 0.19$, $P < 0.0001$), but not with FT_3 or FT_4.

DISCUSSION

We studied 997 USES school children to assess the iodine nutrition of those who are most likely to have benefited from the NIDDCP. The median UIE in these children was 35.28µg/dL, with <1% having iodine deficiency.

TABLE II COMPARISON OF URINARY IODINE WITH ANTI-TPO ANTIBODIES, GOITER AND TSH

Variable	Subjects	Urinary iodine (µg/dL) median (range) or mean (± SD)	*P* value
Anti-TPO Ab titre (IU/L)			
< 34 (negative)	634	35.75 (8.08-42.3)	0.04
≥34 (positive)	17	33.30 (22.9-38.71)	
Goiter grade			
0 (absent)	875	34.04 ± 5.88	0.27
1 or 2 (present)	123	34.67 ± 5.31	
TSH (µIU/mL)			
0.17-5.2 (normal)	697	33.99 ± 5.87	0.0002
>5.2 (elevated)	91	36.32 ± 3.89	

The present study found that 97% of samples had UIE ≥20µg/dL, while 83% had UIE ≥30µg/dL. Pandav, *et al*.(6) in 1997, found median UIE >20µg/dL in 50% of samples, while 33% had >30µg/dL. In a countrywide study done between 1997 and 2000, we reported median UIE ≥20µg/dL in almost 80% of the samples(4). The high UIE of present study could reflect a trend with time with improved penetration and execution of universal salt iodisation. Secondly, previous studies were conducted in children of lower and upper socioeconomic groups. No data of USES children independently is available. Thirdly, a certain degree of variation could be explained by the

TABLE I CLINICAL AND BIOCHEMICAL CHARACTERISTICS OF THE STUDY POPULATION

Characteristic	Boys (*n*=473)	Girls (*n*=524)	Total (*n*=997)
Urinary iodine (µg/dL)			
Median (Range)	35.28 (6.93-42.3)	35.25 (8.08–42.56)	34.19 (6.93–42.56)
Mean (S±D)	34.16 ± 5.71	34.10 ± 5.91	34.12 ± 5.75
Goiter			
Grade 1(%)	57 (12.05)	64 (12.21)	121 (12.14)
Grade 2 (%)	1 (0.21)	1 (0.19)	2 (0.2)
Anti-TPO Ab positive (%)*	6 (1.47)	11 (4.55)	17 (2.61)
Mean FT3 (pM/L)†	4.52 ± 0.71	4.19 ± 0.68	4.36 ± 0.71
Mean FT4 (pM/L)†	15.05 ± 2.50	14.88 ± 2.15	14.96 ± 2.33
Mean TSH (µIU/ml)†	3.33 ± 1.93	3.13 ± 2.97	3.23 ± 2.50

** Anti-TPO Abs done in 651 subjects; † FT3, FT4, TSH done in 789 children.*

WHAT THIS STUDY ADDS?

- This study confirms the improvement in iodine nutrition and indicates evidence for excess iodine nutrition in upper socioeconomic school children as assessed by urinary iodine excretion.

methodology used for UIE, though all are based on the same principle. Fourthly, one has to consider the role of non-salt sources of iodine. Domestic water filters, based on polyiodide resin technology can provide 3000-6000 µg of iodine per day to an individual(7) that could contribute to high UIE.

With higher prevalence of autoimmune thyroiditis in iodine sufficient areas(8) as well as following iodine prophylaxis(9-11), there is a suggestion that iodine ingestion increases thyroid autoimmunity. However, other studies have not found an association between urinary iodine and thyroid antibodies(4,12). The role of iodine nutrition in thyroid autoimmunity is not clear, which is further reinforced by the results of the present study. Possibly, only a subset of the population may be at risk of iodine induced thyroid autoimmunity(13).

We did not find an association between median UIE and goiter. The current data are consistent with our earlier observation that iodine nutrition can explain only a part of the goiter prevalence and goitrogens like thiocyanate add to it(4). Excess iodine has been implicated in thyrotoxicosis as well as suppressed thyroid function. The present study found no correlation of median UIE with FT3 and FT4 but a positive correlation with TSH. Analysis of data from the US NHANES III showed similar findings in adults(14). A recent study from our country showed association of UIE with subclinical hypothyroidism along with AIT(9). Similar findings have been reported from China(10). On grouping the subjects on the basis of TSH, we found UIE to be significantly higher in those with "elevated" TSH (likely hypothyroid group). A recent report from China has shown similar results indicating that excess iodine could lead to impaired thyroid function(15).

A drawback of the present study is that we have neither assessed salt iodine content nor salt consumption. However, with optimum salt iodine content of 15 ppm, a daily intake in excess of 15-20 g would be needed to account for a median UIE of 35 µg/dL.

This study shows evidence of excess iodine nutrition in USES school children. The source of this iodine could be salt or non salt iodine. The increased urinary iodine is associated with thyroid dysfunction though not with goiter.

Contributors: RKM and NT were involved in planning, collection of data, analysis and writing. AD was involved in design, collection of data, laboratory assays, analysis and writing. RK and RA were involved in planning and collection of data. KM was involved in statistical analysis. All authors contributed to drafting. RKM shall stand as the guarantor.

Funding: Institute of Nuclear Medicine and Allied Sciences, Defence Research and Development Organization.

Competing interests: None stated.

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